

XXXIII. MIL03346

Clinopyroxenite

715 grams



Figure XXXIII-1: Processing photo of MIL03346. Cube is 1 cm, for scale. Photo is from newsletter.

Introduction

The Mars Exploration Program supplemented the 2003-2004 ANSMET expedition in the hope of improving the chance of finding additional samples of Mars. As luck would have it, a very black rock was recovered from the blue ice on Dec 15, 2003 in the Miller Range, among the other 1358 new specimens discovered during this field season.

<http://geology.cwru.edu/~ansmet/>

The first round of sample requests indicated the interest of about 50 scientific teams world wide. Stay tuned.

Petrography

MIL03346 is a new nakhlite with about 60% fusion crust. Initial description by the PET indicates it might be similar to Lafayette (see chapter III). Figure XXXIII-1 illustrates the initial subdivision, prior to formal allocations. MIL03346 appears to have abundant clinopyroxene and mesostasis with some alteration (figure XXXIII-2).

A brief petrography description is available at:

<http://www-curator.jsc.nasa.gov/curator/antmet/amn/amnaug04/petdes2.htm#MIL03346>



Figure XXXIII-2: Thin section photomicrograph of MIL03346. Scale bar is 1 mm. Euhedral clinopyroxene is set in fine-grained mesostasis (opaque). Areas of apparent alteration are present. Photo is from newsletter.

ANSMET

The Antarctic Search for Meteorites



Why Antarctica?



The Journey



Collecting Meteorites



Meteorite Portraits



Links



Info for Field
Party Members



Living on the East
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Final Words



Frequently Asked
Questions



Reconnaissance

[Why Antarctica?](#) | [The Journey](#) | [Collecting Meteorites](#) | [Meteorite Portraits](#) | [Links](#)
[Info for Party Members](#) | [Living on the East Antarctic Icesheet](#) | [Reconnaissance](#)
[Past Field Team Links](#) | [Final Words](#) | [Frequently Asked Questions](#)

Welcome to the home page of ANSMET (The Antarctic Search for Meteorites program). This homepage has been designed to give you a pictorial tour of

how and why ANSMET hunts for meteorites in the Antarctic. The images have been provided by field party members from the 20 field seasons ANSMET has had since 1976. ANSMET is a program supported by grants from the Office of Polar Programs of the U.S. National Science Foundation and by the Solar System Exploration Division of NASA. The Principal Investigator of the current grant is Dr. [Ralph P. Harvey](#) of the [Department of Geological Sciences at Case Western Reserve University](#). Prof. [William A. Cassidy](#) of the University of Pittsburgh was the founder of ANSMET and Principal Investigator until 1991. [John Schutt](#) has been our field safety officer since 1980. Since 1976, ANSMET has been recovering meteorite specimens from the East Antarctic Icesheet- a total of over 10,000 as of today.

Questions about the ANSMET program itself should be directed to [Ralph P. Harvey](#) , who charges only a modest connection fee.

Questions can also be directed to [William A. Cassidy](#) , who can find meteorites with his eyes closed.

Questions about field operations or climbing might be directed to [John W. Schutt](#) , but you might as well just put a message in a bottle.

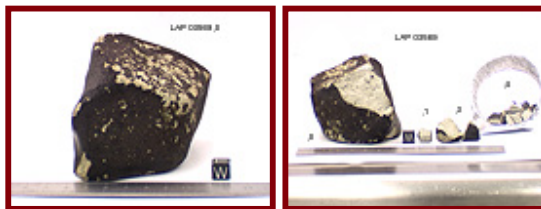
The new, improved ANSMET web site was originally designed and implemented by Peter Lindstrom.

Last updated 27 June 2003 by rph

Petrographic Descriptions

[Go to Pet. Desc. Page 1 of 2](#)

Sample No.: LAP 03569
Location: LaPaz Ice Field
Field No.: 16919
Dimensions (cm): 10.5x8.0x7.0
Weight (g): 813.7
Meteorite Type: Diogenite

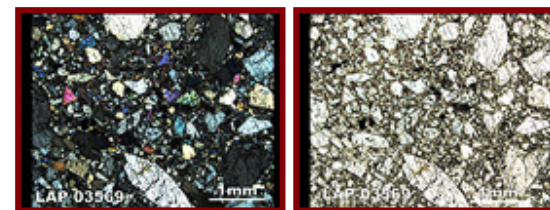


Macroscopic Description: Kathleen McBride

75% of the exterior is covered with chocolate brown fusion crust. The crust has a slight sheen with polygonal fractures. The exposed matrix is tan and has weathered, large green inclusions. The interior matrix is light gray with olive green angular inclusions.

Thin Section (,2) Description: Tim McCoy, Linda Welzenbach

The section shows a groundmass of coarse (up to 3 mm) comminuted pyroxene, with lesser olivine. Orthopyroxene has a composition of $\text{Fs}_{22}\text{Wo}_{78}$ and an Fe/Mn ratio of ~28; olivine is Fa_{27} . The meteorite is a diogenite and is compositionally similar to LAP 91900 and LAP 02216. It could be paired with the latter, although it contains much more abundant olivine.



Cross-Polarized Light

Plane-Polarized Light

Sample No.: LAP 03593; LAP 03605; LAP 03631
Location: LaPaz Icefield
Field No.: 16731; 16721; 16715
Dimensions (cm): 8.0x6.0x5.5
 9.5x5.5x4.5
 7.5x3.5x3.5
Weight (g): 657.5; 582.8; 164.9
Meteorite Type: Iron (Sulfide-Rich)



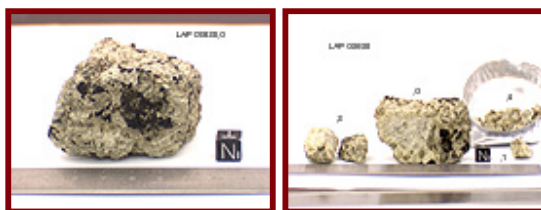
Macroscopic Description: Tim McCoy, Lisa Collins

These meteorites exhibit a common external appearance. They have a knobby surface with numerous rounded protrusions up to 1 cm across intermixed with indentations containing a macroscopically jointed mineral.

Microscopic Description: Tim McCoy, Linda Welzenbach

These meteorites were examined from a cut surface of LAP 03593, which displays a sub equal mixture of metal and sulfide with trace amounts of schreibersite and silicates or graphite. The troilite occurs as irregular blobs up to 3 cm in length each of which is composed of multiple troilite crystals 3-5 mm across and exhibit prominent parallel jointing. The metal contains swathing kamacite rims typically 1 mm thick and short irregular bars of kamacite approximately < 0.5 mm. A heat altered α_2 structure extends up to 5 mm from the exterior weathered surface, and a highly altered fusion crust may be preserved in some places. The meteorites are similar to the IAB iron Pitts and the ungrouped iron Soroti, but exhibit coarser kamacite band widths than either, and lack the abundant silicates seen in Pitts.

Sample No.: LAP 03630
Location: LaPaz Ice Field
Field No.: 16049
Dimensions (cm): 5.5x4.0x3.5
Weight (g): 175.672
Meteorite Type: Diogenite

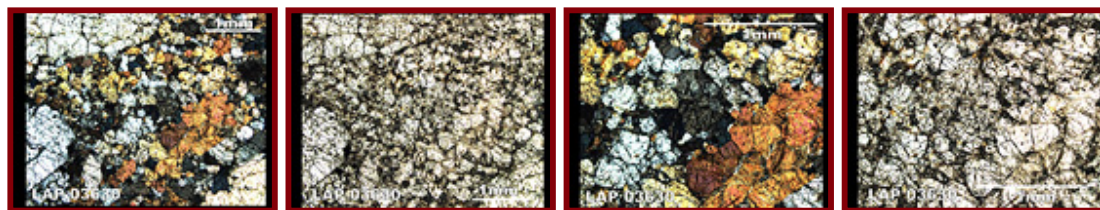


Macroscopic Description: Kathleen McBride

The exterior has small patches of chocolate brown crust (<10%) visible on the exterior. Areas without fusion crust show a tan matrix with green clasts visible. The interior matrix is light gray with olive green, angular inclusions.

Thin Section (,2) Description: Tim McCoy, Linda Welzenbach

The section is dominated by orthopyroxene, with individual grains reaching over 5 mm. The majority of the section consists of smaller (1 mm), equant grains which commonly intersect at 120° triple junctions. Orthopyroxene has a composition of $\text{Fs}_{24}\text{Wo}_2$ and an Fe/Mn ratio of ~28. The meteorite is a diogenite, although its texture is unusual.



LAP 03630
Cross-Polarized Light

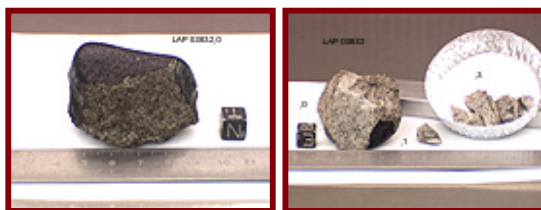
LAP 03630
Plane-Polarized Light

LAP 03630
Cross-Polarized Light

LAP 03630
Plane-Polarized Light

Sample No.: LAP 03632
Location: LaPaz Ice Field

Field No.: 16823
 Dimensions (cm): 5.5x3.5x3.0
 Weight (g): 92.566
 Meteorite Type: Lunar-Basalt

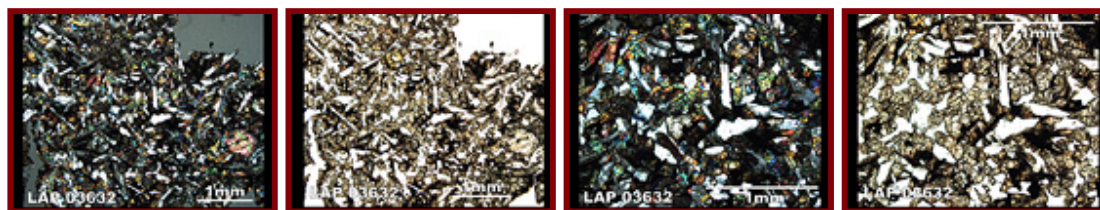


Macroscopic Description: Kathleen McBride

~75% of the exterior has shiny black fusion crust. The interior is pinkish-tan with white linear minerals and glass veins. This sample is paired with the LAP samples from the '02 season.

Thin Section (,2) Description: Tim McCoy, Linda Welzenbach

The section consists of a coarse-grained unbrecciated basalt with elongate pyroxene (up to 0.5 mm) and plagioclase laths (up to 1 mm) (~60:40 px:plag), rare phenocrysts of olivine (up to 1 mm) and interstitial oxides and late-stage mesostasis. Shock effects include undulatory extinction in pyroxene and shock melt veins and pockets. Microprobe analyses reveal pigeonite to augite of $\text{Fs}_{27-52}\text{Wo}_{12-33}$, plagioclase is $\text{An}_{87}\text{Or}_{0-1}$ and a single olivine phenocryst is Fa_{32-99} . The Fe/Mn ratio in the pyroxenes averages ~60. The meteorite is a lunar olivine-bearing basalt and is almost certainly paired with LAP 02205, LAP 02226, LAP 02224 and LAP 02436.



LAP 03632
Cross-Polarized Light

LAP 03632
Plane-Polarized Light

LAP 03632
Cross-Polarized Light

LAP 03632
Plane-Polarized Light

Sample No.: LAP 03719
Location: LaPaz Ice Field
Field No.: 16255
Dimensions (cm): 5.5x4.0x2.5
Weight (g): 62.021
Meteorite Type: Aubrite (Anomalous)



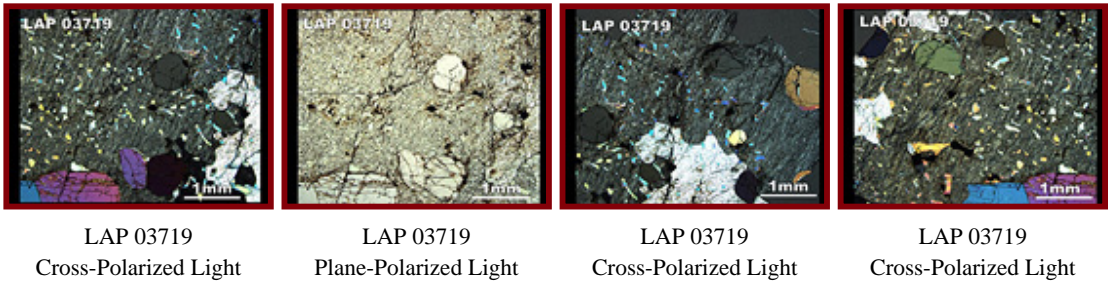
Macroscopic Description: Kathleen McBride

The exterior has 40% fusion crust, gray-brown in color. The interior is a white matrix with brown circular to oval shaped inclusions. The matrix is stained brown and has lots of rust/weathering.

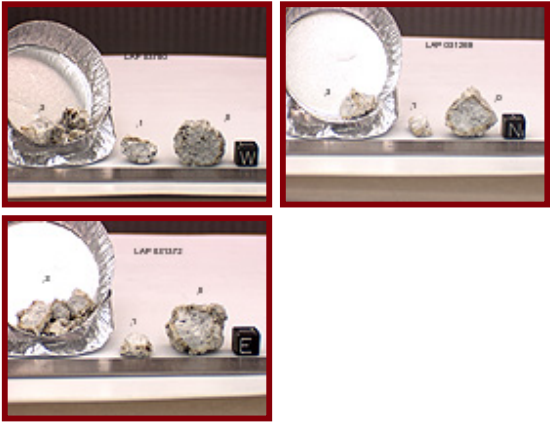
Thin Section (,2) Description: Tim McCoy, Linda Welzenbach

The section is an unbrecciated rock consisting of essentially FeO-free enstatite, diopside and olivine with minor metal, troilite, daubreelite and alabandite. Enstatites reach 1 cm in maximum dimension and contacts between enstatite grains are often interfingering. Blebbly diopside exsolution occurs within enstatite and at enstatite-enstatite grain boundaries.

Olivine, which occupies ~20% of the section, reaches 3 mm. Although the pyroxene textures are reminiscent of some aubrite clasts, the unbrecciated nature, texture and olivine abundance in this aubrite are unique.



Sample No.: LAP 03780; LAP 031269; 031372
Location: LaPaz Icefield
Field No.: 16745; 16191; 16719
Dimensions (cm): 3.5x2.5 x 2.0
2.5x2.5x2.0
3.0x2.0x2.5
Weight (g): 21.807; 12.930; 17.613
Meteorite Type: Aubrite

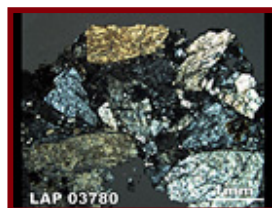


Macroscopic Description: Kathleen McBride

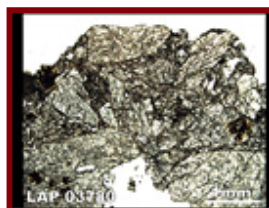
The exteriors are white without any fusion crust. The interiors are white matrix with brown circular to oval shaped inclusions.

Thin Section (,2) Description: Tim McCoy, Linda Welzenbach

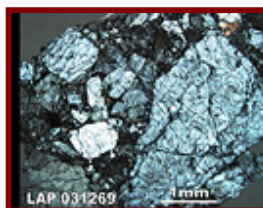
The sections consist of an aggregate of coarse (up to 5 mm), heavily shocked enstatite grains with minor to trace abundances of diopside, metal, troilite, alabandite, and daubreelite. Silicates are essentially FeO-free enstatite (Fs₀Wo₁) and diopside (Fs₀Wo₄₃). The meteorites are aubrites and may be paired with LAP 02233. They were found over a range of 1.5 km.



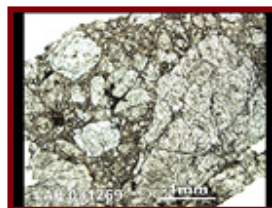
LAP 03780
Cross-Polarized Light



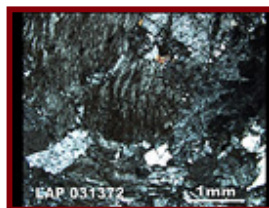
LAP 03780
Plane-Polarized Light



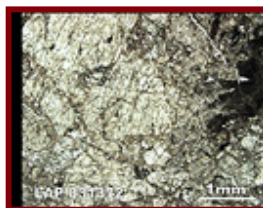
LAP 031269
Cross-Polarized Light



LAP 031269
Plane-Polarized Light



LAP 031372
Cross-Polarized Light



LAP 031372
Plane-Polarized Light

Sample No.: LAP 03782
Location: LaPaz Ice Field
Field No.: 16082
Dimensions (cm): 2.5x2.5x1.75
Weight (g): 22.269
Meteorite Type: Eucrite (Unbrecciated)

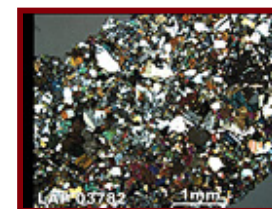


Macroscopic Description: Kathleen McBride

The exterior of this eucrite has about 40% thin, black, shiny fusion crust. The interior has a dense crystalline matrix with minor rust and is very hard.

Thin Section (,2) Description: Tim McCoy, Linda Welzenbach

This meteorite exhibits a granoblastic texture, with pyroxenes reaching 1.5 mm and plagioclase 1.0 mm, although most grains are smaller. Pyroxenes are exsolved on the scale of 1-20 microns, with orthopyroxene ($\text{Fs}_{58}\text{Wo}_4$), with lamellae of augite ($\text{Fs}_{30}\text{Wo}_{37}$), and plagioclase ($\text{An}_{90}\text{Or}_{10}$). The Fe/Mn ratio of the pyroxene is ~30. Staining by hydrated iron oxides is pervasive. The meteorite is an unbrecciated eucrite.

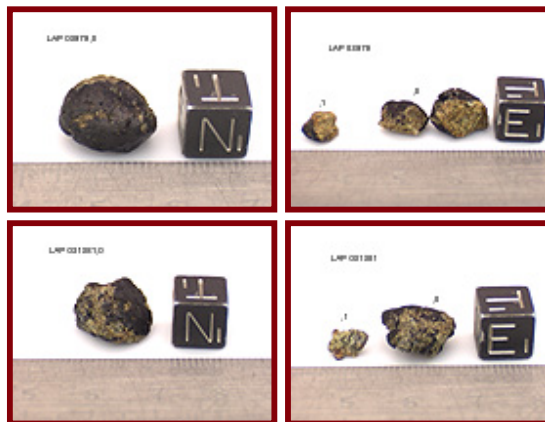


Cross-Polarized Light



Plane-Polarized Light

Sample No.: LAP 03979; LAP 031381
Location: LaPaz Icefield
Field No.: 16489; 16628
Dimensions (cm): 1.5x1.25x0.75
 1.5x1.25x0.75
Weight (g): 2.406; 1.890
Meteorite Type: Diogenite (Olivine)

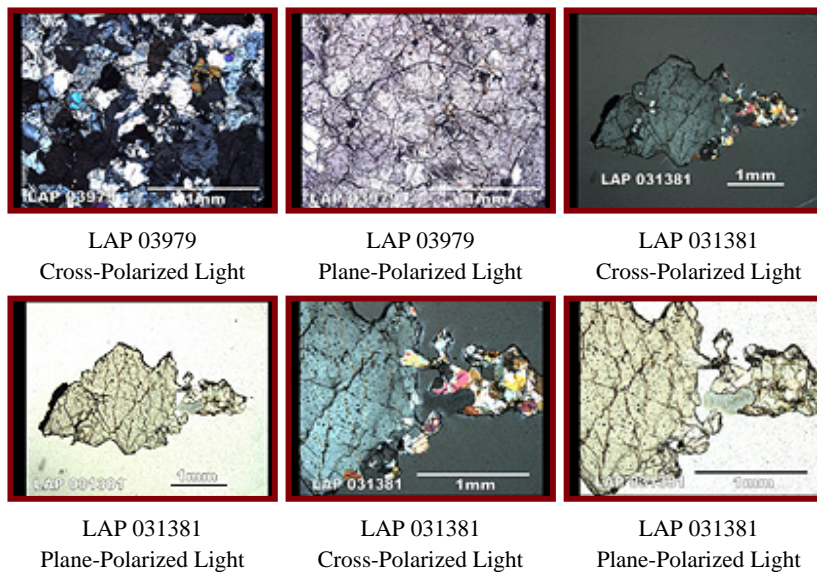


Macroscopic Description: Kathleen McBride

95% of the exterior is covered with brown/black fusion crust with small shiny patches. The rusty, granular interior has mm sized black inclusions and green mineral grains that are up to 2 mm in size.

Thin Section (,2) Description: Tim McCoy, Linda Welzenbach

These two small sections are unbrecciated rocks dominated by orthopyroxene ($\text{Fs}_{25}\text{Wo}_{75}$), olivine (Fa_{30}) and plagioclase ($\text{An}_{80-85}\text{Or}_{15}$). Most grains are less than 0.5 mm in diameter, although a single pyroxene in 031381 reaches 4 mm. The meteorites are unbrecciated olivine diogenites.



Sample No.: MIL 03346
Location: Miller Range
Field No.: 13205
Dimensions (cm): 10.0x6.0x5.5
Weight (g): 715.200
Meteorite Type: Nakhlite

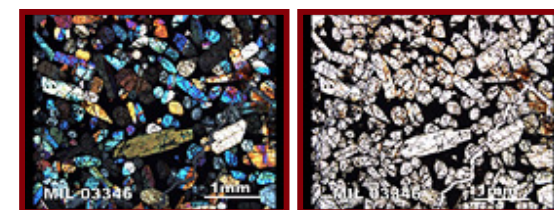


Macroscopic Description: Kathleen McBride

60% of the exterior is covered with black "wrinkled" appearing fusion crust. The areas without fusion crust are a black crystalline material with vugs. The binocular microscopic view of the exterior surface appears melted or fused together. The interior reveals a coarse grained, dark green to blackish crystalline matrix with a granular texture. This nakhlite is unbrecciated and homogeneous with interlocking grains and minor rust.

Thin Section (,2) Description: Tim McCoy, Cari Corrigan, Linda Welzenbach

The section is dominated by lathy to equant clinopyroxene that reaches 2 mm in maximum dimension. Mesostasis occupies approximately 20% of the rock and contains skeletal iron-titanium oxides. Clinopyroxenes have core compositions of $\text{Fs}_{21} \text{Wo}_{40}$ with rims reaching $\text{Fs}_{49} \text{Wo}_{34}$. Olivine was not observed. The meteorite is a nakhlite. Its pyroxenes are compositionally similar to Lafayette, but it is richer in mesostasis and unusual for nakhrites in lacking olivine.



Cross-Polarized Light

Plane-Polarized Light

Sample No.: MIL 03356
Location: Miller Range
Field No.: 13970
Dimensions (cm): 7.5x4.5x3.0
Weight (g): 443.5
Meteorite Type: Iron-IVA



Macroscopic Description: Tim McCoy, Lisa Collins

This slipper-shaped meteorite has a smooth exterior surface partially (30-50%) covered by fusion crust which exhibits prominent flow lines. Prominent fracturing, which follows the Widmānstatten structure, extends to the interior along the end opposite the nose. An interesting feature is the presence of two holes, about 1 mm in diameter and of depth equal to or greater than the diameter, one of which contains a single euhedral metal crystal.

Microscopic Description: Tim McCoy, Linda Welzenbach

The meteorite was examined from a cut and etched surface, which bisected the larger end or nose of the specimen. The surface exhibits prominent kamacite lamellae (L/W ~20) with bandwidths less than 0.2-0.3 mm set in approximately 40-50% plessite fields. Rare, very small troilite inclusions, up to 1mm are present. An elongate needle, 2.5 mm long, of chromite(?) is also present. The meteorite appears to have been extensively shocked and exhibits α_2 structure throughout the meteorite and prominent Neumann bands in many of the kamacite lamellae. A thin fusion crust is preserved over much of the surface, and a heat altered zone approximately 0.5 mm thick underlies that fusion crust. The meteorite is similar to the IVA iron Duchesne.

Sample No.: MIL 03369
Location: Miller Range
Field No.: 13972
Dimensions (cm): 5.0x2.5x2.0
Weight (g): 119.963
Meteorite Type: Iron-IIIIC



Macroscopic Description: Tim McCoy, Lisa Collins

This lozenge-shaped meteorite has a rounded exterior peppered with 3 mm rust halos, and has a single comma shaped indentation. Most of the surface is relatively smooth, while the bottom face shows a subtle relief of the Widmānstätten pattern.

Microscopic Description: Tim McCoy, Linda Welzenbach

The meteorite was examined from a cut and etched surface, which bisects the long axis of the specimen. The cut surface exhibits prominent skeletal kamacite lamellae (L/W ~50) with bandwidths less than 0.2-0.5 mm set in approximately 40-50% plessite fields of both comb (~10%) and martensite (30-40%). The kamacite typically contain minute lathes of schreibersite crystals arrayed along the central long axis. The meteorite exhibits α_2 structure throughout the prominent fissures in many of the kamacite lamellae. A thin fusion crust is preserved over some parts, and a heat altered zone approximately 0.5 mm thick underlies that fusion crust. The meteorite is similar to the IIIIC iron Carlton, although appears to be more shock altered than Carlton.

Go to Pet. Desc. Page 1 of 2